

**EDUCATION:**

Bachelor of Arts  
Cornell University, College of Arts and Sciences  
Ithaca, New York

Doctor of Medicine  
Creighton University School of Medicine  
Omaha, Nebraska

**POSTDOCTORAL TRAINING:**

Surgical Intern  
Rhode Island Hospital, Providence, R.I.

Resident in Otolaryngology  
New York Hospital, New York, NY

Resident in Otolaryngology  
Mount Sinai Hospital, New York, N.Y.

Research Fellow  
Department of Otolaryngology, Mount Sinai School of  
Medicine, New York, N.Y.

**SPECIALTY CERTIFICATION AND LICENSURE:**

**American Board of Otolaryngology 1984 New York  
State - Number 146699 1981 New Jersey - Number  
HA43552 1984**

**ACADEMIC APPOINTMENTS:**

**Clinical Assistant Professor 1984-86**  
Department of Otolaryngology,  
Mount Sinai School of Medicine, New York, N.Y.

**Assistant Professor 1986-91**  
Department of Otolaryngology,  
Mount Sinai School of Medicine, New York, N.Y.

**Director 1988-97**  
Doctor Eugen Grabscheid Center for Voice Disorders,

Mount Sinai School of Medicine, New York, N.Y.

**Director of Residency Education 1989-1997**

Department of Otolaryngology,  
Mount Sinai School of Medicine, New York, N.Y.

**Associate Professor 1991-2003**

Department of Otolaryngology,  
Mount Sinai School of Medicine, New York, N.Y.

**Senior Researcher 1997-present**

Grabscheid Center for Voice Disorders  
Mount Sinai School of Medicine, New York, N.Y.

**HOSPITAL APPOINTMENTS:**

**Mount Sinai Hospital 1984-present**

Manhattan, New York City

**Bronx Veterans Administration Hospital 1984-2001**

Bronx, New York City

**Elmhurst Hospital 1984-2002**

Queens, New York City

**Cabrini Medical Center 1997-2000**

Manhattan, New York City

**Queens Hospital 1997-2002**

Queens, New York City

**Castle Point Veterans Administration Hospital 2000-2002**

Castle Point, N.Y.

## HONORS

- 1986 American Broncho-Esophagological Association Resident Research Award
- 1987 American Broncho-Esophagological Association Resident Research Award
- 1987 Association for Research in Otolaryngology Resident Research Award
- 1987 New York Academy of Medicine Resident Research Award in Otolaryngology
- 1988 Association for Research in Otolaryngology Resident Research Award
- 1989 American Laryngological Association Resident Research Award
- 1989 Resident Research Award in Otolaryngology, New York Academy of Medicine
- 1990 Research Award, Honorable Mention, Eastern Triological Society
- 1992 Presidential Award for Research, American Academy of Otolaryngology
- 1993 Cover Photograph, Laryngoscope (February)
- 1994 Cover Photograph, Laryngoscope (July)
- 1994 The Casselberry Award, American Laryngological Association
- 1995 Editorial Comment on Manuscript in Archives of Otolaryngology
- 1996 Honor Award for Research, American Academy of Otolaryngology
- 1997 Young Faculty Research Award, American Laryngological Association
- 1997 Broyles-Maloney Award, American Broncho-Esophagological Association
- 1998 Cover Photograph, Anatomical Record (February)
- 1999 Cover Photograph, Anatomical Record (March)
- 1999 Cover Photograph, Anatomical Record (October)
- 2000 Resident Research Award, Eastern Triological Society
- 2000 Broyles-Maloney Award, American Broncho-Esophagological Association
- 2000 Resident Research Award, Mount Sinai Department of Otolaryngology
- 2001 Shannon Award, National Institutes of Health

**2003** Broyles-Maloney Award, American Broncho-Esophological Association

**2004** Entrepreneur Award, Cornell University College of Business Administration

## **RESEARCH SUPPORT**

### **National Institutes of Health - Principal Investigator**

**1990-1993** PI: Ira Sanders, MD RO1 DC01143 - Development of a Laryngeal Pacer National Institute on Deafness and Other Communication Disorders

**1993-1996** PI: Ira Sanders, MD RO1 DC01764 - Neuromuscular Compartments of Laryngeal Muscles National Institute on Deafness and Other Communication Disorders

**1996-2000** PI: Ira Sanders, MD RO1 DC01764 - Neuromuscular Compartments of Laryngeal Muscles National Institute on Deafness and Other Communication Disorders

**2000-2001** PI: Ira Sanders, MD Anatomical Aspects of Tongue Biomechanics Shannon Award, National Institutes of Health

**2001-2004** PI: Ira Sanders, MD R01 DC004684 - Anatomical Aspects of Tongue Biomechanics National Institute on Deafness and Other Communication Disorders

### **National Institutes of Health - Co-Investigator**

**1996-2001** PI: Patrick Brookhauser MD U01DC03209-Otolaryngology Clinical Trials Cooperative Group National Institute on Deafness and Other Communication Disorders CI and member, Scientific Advisory Committee

**1996-1998** PI: Liancai Mu, MD, RO3 DC02695 - Pharyngeal Swallowing, Human Neuroanatomy National Institute on Deafness and Other Communication Disorders

**1999-2004** PI: Liancai Mu, MD RO3 DC02695 Neuromuscular Compartments of Human Pharyngeal Muscles

**Other Research Support:**

1989

New York Lung Association  
Electromyography of the Canine Posterior Cricoarytenoid Muscle.

1995

Medtronic Corporation  
Animal Trials of the Itrel II Laryngeal Pacer

1996

Allergan Inc  
The Neuromuscular Motor Endplates of the Human Biceps Muscles.

1996

Medtronic Inc  
Clinical Trials of Laryngeal Pacer PI: Ira Sanders, MD

1997

Allergan Inc  
Diffusion of Botulinum Toxin PI: Ira Sanders, MD

1998

Dean's Research Seed Fund PI: Ira Sanders, M.D.

1999

Dean's Research Enhancement Award  
PI: Donald Weisz, PhD, CI: Ira Sanders, M.D

2003

American Laryngological Association Voice Research  
PI: Asif Amirali MD, CI: Ira Sanders, MD

## **CHAPTERS**

Sanders I, Biller HF: Trauma to the larynx, n  
Ballinger JJ (ed), Diseases of the Nose, Throat, Ear,  
Head and Neck. Lea and Feigner, 14<sup>th</sup>, 1991.

Sanders I: Electrical stimulation of laryngeal muscle, in  
Otolaryngology Clinics of North America,  
Voice Disorders 24: No.5, 1253-1274, 1991.

Shaari CM, Sanders I: Assessment of the biological activity of Botulinum toxin in:  
Joseph Jankovic, editor,  
Therapy with Botulinum Toxin,  
Marcel Dekker, Inc. New York, Basel Hong Kong,  
11:159-169, 1994.

Sanders I: The Microanatomy of the Vocal Folds.  
In Rubin et al (eds), Diagnosis and Treatment of  
Voice Disorders. Igaku-Shoin, Tokyo, Japan. 1995.

Sanders I.  
Microanatomy of the Vocal Fold Musculature  
in (Eds) Rubin J, Sataloff RT, Korovin GW  
Diagnosis and Treatment of Voice Disorders, Second Edition  
Delmar Learning Clifton Park, NY (2002)

Amirali A, Sanders I  
The Glycogen Depletion Assay and the Measurement of Botulinum Toxin Injections. In Brin MF,  
Hallet M, Jankovic J, eds, Scientific and Therapeutic Aspects of Botulinum Toxin. Lippincott  
Williams and Wilkins, Philadelphia, Penn (2002)

## PEER-REVIEWED PUBLICATIONS

### 1986

Sanders I, Aviv JE, Biller HF:  
Transcutaneous electrical stimulation of the recurrent laryngeal nerve.  
Otolaryngology Head and Neck Surgery 95:152-157, 1986.

Sanders I, Aviv JE, Kraus WM, Racenstein M, Biller HF:  
Transcutaneous stimulation of the recurrent laryngeal nerve in monkeys.  
Ann Otol Rhinol Laryngol 96(1): 38-42, 1986.

### 1987

Sanders I, Kraus WM, Aviv JE, Biller HF:  
Transtracheal/transesophageal stimulation of the recurrent laryngeal nerve.  
Laryngoscope; 97:663-667, 1987.

Kraus WM, Sanders I, Aviv JE, Biller HF: Laryngeal electrode platform: An indwelling device for mobilizing the vocal cords. Ann Otol Rhinol Laryngol 96:(6)674-679, 1987.

### 1989

Sanders I, Kraus WM, Morel B, Wu BL, Biller HF:  
Transmucosal electrical stimulation of laryngeal muscles.  
Ann Otol Rhinol Laryngol 98:339-345, 1989.

Aviv JE, Sanders I, Silva D, Kraus WM, Wu BL, Biller HF:  
Overcoming laryngospasm by electrical stimulation of the posterior cricoarytenoid muscle.  
Otolaryngology Head Neck Surgery. 100:110-118, 1989.

### 1990

Aviv JE, Sanders I, Biller HF:  
Abductor vocal cord spasm.  
Otolaryngology Head and Neck Surgery 102:223-238, 1990.

Jacobs I, Sanders I, Wu BL, Biller HF:  
Reinnervation of the canine posterior cricoarytenoid muscle with sympathetic preganglionic neurons.  
Ann Otol Rhinol Laryngol 99:167-174, 1990.

1991

Shaari C, George E, Wu BL, Biller HF, Sanders I:  
Quantifying the spread of Botulinum toxin through muscle fascia.  
Laryngoscope 101:960-964, 1991.

1992

Diamond A, Sanders I, Biller HF:  
Intramuscular nerve supply of canine posterior cricoarytenoid muscle.  
Laryngoscope 102:272-276, 1992

George EF, Zimble MS, Wu BL, Biller HF, Sanders I:  
Quantitative mapping of the effect of botulinum toxin injections in the thyroarytenoid muscle.  
Ann Otol Rhinol Laryngol 101:888-892, 1992.

Wu BL, Sanders I:  
A technique for demonstrating the nerve supply of whole larynges.  
Arch Otolaryngol 118; 822-827, 1992

Zaretsky L, Sanders I:  
The three bellies of the canine cricothyroid muscle.  
Ann Otol Rhinol Laryngol Supplement 156:101, Number 2, Part 2, 1992

Silva D, Sanders I:  
Continuous positive airway pressure as a promoter of laryngospasm during halothane anesthesia.  
Ann Otol Rhinol Laryngol 101:893-896, 1992

Simpson DM; Kaufmann H; Sanders I; Wolfe DE:  
Laryngeal dystonia in multiple system atrophy.  
Muscle & Nerve 1213-1215, 1992

1993

Sanders I, Jacobs I, Wu BL, Biller HF:  
The three bellies of the canine posterior cricoarytenoid muscle: Implications for understanding laryngeal function.  
Laryngoscope 103:171-177; 1993.



Drake W, Li Y, Rothschild MA, Wu BL, Biller HF, Sanders I:  
A technique for displaying the entire nerve branching pattern of a whole muscle:  
Results in ten canine posterior cricoarytenoid muscles.  
Laryngoscope 103:141-148, 1993.

Simpson D, Sternman D, Graves-Wright J, Sanders I:  
Vocal cord paralysis: Clinical and electrophysiologic features.  
Muscle & Nerve 16:952-957, 1993.

Sanders I, Mu L, Wu BL, Biller HF:  
The intramuscular nerve supply of the human lateral cricoarytenoid muscle.  
Acta Otolaryngol (Stockh) 113:679-682, 1993.

Shaari C, Sanders I:  
Quantifying how location and dose of botulinum toxin injections affect muscle paralysis.  
Muscle & Nerve 16:964-969, 1993.

Sanders I, Wu, BL, Mu LC, Li Y, Biller HF:  
The innervation of the human larynx.  
Arch Otolaryngol Head Neck Surgery 119:934-939, 1993

#### 1994

Mu L, Sanders, I, Wu, BL, Biller HF:  
The intramuscular innervation of the human interarytenoid muscle.  
Laryngoscope 104:33-39, 1994

Sanders I, Rao F, Biller HF:  
Arytenoid motion evoked by regional electrical stimulation of the canine posterior  
cricothyroid muscle.  
Laryngoscope 104:458-462; 1994.

Wu BL, Sanders I, Biller HF:  
The human communicating nerve: An extension of the external superior laryngeal nerve  
that innervates the vocal cord.  
Arch of Otolaryngol. Head Neck Surg 120:1321-1328; 1994

Sanders I, Wu BL, Mu L, Biller HF:  
The innervation of the human posterior cricoarytenoid muscle: Evidence for at

least two neuromuscular compartments.  
Laryngoscope 104:880-884, 1994

**1995**

Sanders I, Li Y, Biller HF:  
Axons enter the human posterior cricoarytenoid muscle from the superior direction.  
Arch Otolaryngol Head Neck Surg. 121:754-757, July 1995.

Wu BL, Sanders I:  
The Sihler's Stain: a technique for studying peripheral nerves in whole-mount specimens.  
Neuroscience Protocols 94-050-07-01-11

Shaari CM, Sanders I, Wu BL, Biller HF:  
Rhinorrhea is decreased in dogs after nasal application of botulinum toxin.  
Otolaryngol. Head Neck Surg 112:566-571; 1995

**1996**

Mu LC, Sanders I:  
The innervation of the human upper esophageal sphincter.  
Dysphagia. 11: 234-238, 1996.

Sanders I, Wu BL, Biller HF:  
Phonatory specializations of human laryngeal muscle.  
Transactions of the American Laryngological Association

**1998**

Sanders I, Han Y, Wang J, Biller HF:  
Muscle spindles are concentrated in the superior vocalis sub compartment of the human thyroarytenoid muscle.  
J Voice 12:7-17, 1998.

Sanders I, Han Y, Rai S, Biller HF:  
Human vocalis contains distinct superior and inferior sub compartments: Possible candidates for the two masses of vocal fold vibration.  
Ann Otol Rhinol Laryngol 107(10): 826-833, 1998.

Mu LC, Sanders I:  
The neuromuscular organization of the human upper esophageal sphincter.  
Ann Otol Rhinol Laryngol 107(10): 370-377,1998.

Ziccardi VB, Mu L, Schneider RE, Sanders I.  
Innervation pattern of the human temporalis muscle.  
J Craniofac Surg. 9:185-9, 1998.

Shaari C, Wu BL, Biller HF, Chuang SK, Sanders I:  
Botulinum toxin decreases salivation from canine submandibular glands.  
Otolaryngol Head Neck Surg 118:482-7; 1998.

Mu LC, Sanders I:  
Neuromuscular specializations of the pharyngeal dilator muscles: I. Compartments of the canine geniohyoid muscle.  
Anat Rec. 1998 Feb; 250(2): 146-53.

Sanders I, Mu LC:  
Anatomy of the human internal superior laryngeal nerve.  
Anat Rec 252:646-656, 1998.

## 1999

Hillel AD, Benninger M, Blitzer A, Crumley R, Flint P, Kashima HK, Sanders I, Schaefer S:  
Evaluation and management of bilateral vocal cord immobility.  
Otolaryngol Head Neck Surg 121:760-5,1999.

Han Y, Wang J, Fischman D, Biller HF, Sanders I:  
Slow Tonic Myosin in the Human Vocal Fold: A Possible Specialization for Speech.  
Anat Rec 256: 1-12, 1999.

Shaari CM, Gannon PJ, Salmeron J, Sanders I, Urken ML.  
Tracheal transplantation: defining the vascular territory of canine thyroid artery.  
Otolaryngol Head and Neck Surg, 120:180-3, 1999.

Mu LC, Sanders I:  
Neuromuscular organization of the canine tongue.  
Anat Rec 258: 421-24, 1999.

**2000**

Mu LC, Sanders I:  
Sensory nerve supply of the human oro- and laryngopharynx: A preliminary study.  
Anat Rec 258:406-420, 2000.

Mu LC, Sanders I.:  
Neuromuscular specializations of the pharyngeal dilator muscles:

II. Compartmentalization of the canine genioglossus muscle.  
Anat Rec, 260:308-25, 2000.

**2001**

Amirali A, Schraeder N, Weisz D, Sanders I:  
Mapping of brain stem neuronal circuitry active during swallowing.  
Ann Otol Rhinol Laryngol 110:6 502-13, 2001.

Mu L, Sanders I.  
Neuromuscular compartments and fiber-type regionalization in the human inferior pharyngeal constrictor muscle.  
Anat Rec. 2001 Dec 1;264(4):367-77.

**2002**

Mu L, Sanders I.  
Muscle fiber-type distribution pattern in the human cricopharyngeus muscle.  
Dysphagia. 2002 Spring;17(2):87-96.

**2003**

Zeale DL, Billante CR, Courey MS, Nettekville JL, Paniello RC, Sanders I, Herzon GD, Goding GS, Mann W, Ejinell H, Habets AM, Testerman R, Van de Heyning P.  
Reanimation of the paralyzed human larynx with an implantable electrical stimulation device.  
Laryngoscope. 2003 Jul;113(7):1149-56.

Iskander A, Sanders I.  
Morphological comparison between neonatal and adult human tongues.  
Ann Otol Rhinol Laryngol. 2003 Sep;112(9 Pt 1):768-76.

**2004**

Zur KB, Mu L, Sanders I.  
Distribution pattern of the human lingual nerve.  
Clin Anat. 2004 Mar;17(2):88-92.

Mu L, Su H, Wang J, Han Y, Sanders I.  
Adult human mylohyoid muscle fibers express slow-tonic, alpha-cardiac, and developmental myosin heavy-chain isoforms.  
Anat Rec A Discov Mol Cell Evol Biol. 2004 Aug;279(2):749-60.

**2007**

Mu L, Wang J, Su H, Sanders I.  
Adult human upper esophageal sphincter contains specialized muscle fibers expressing unusual myosin heavy chain isoforms.  
J Histochem Cytochem. 2007 Mar;55(3):199-207. Epub 2006 Oct 30.

Mu L, Su H, Wang J, Sanders I.  
Myosin heavy chain-based fiber types in the adult human cricopharyngeus muscle.  
Muscle Nerve. 2007 May;35(5):637-48.

Mu L, Sanders I.  
Neuromuscular specializations within human pharyngeal constrictor muscles.  
Ann Otol Rhinol Laryngol. 2007 Aug;116(8):604-17.

**2008**

Cheetham J, Radcliffe CR, Ducharme NG, Sanders I, Mu L, Hermanson JW.  
Neuroanatomy of the equine dorsal cricoarytenoid muscle: surgical implications.  
Equine Vet J. 2008 Jan;40(1):70-5.

Mu L, Sanders I.  
The Human Cricothyroid Muscle: Three Muscle Bellies and Their Innervation Patterns.  
J Voice. 2008 Jan 10.

Doty RL, Cummins DM, Shibanova A, Sanders I, Mu L.  
Lingual distribution of the human glossopharyngeal nerve.  
Acta Otolaryngol. 2008 Jun 12:1-5.

**2009**

Mu L, Sanders I. The human cricothyroid muscle: three muscle bellies and their innervation patterns. J Voice. 2009 Jan;23(1):21-8.

Mu L, Sanders I. Sihler's whole mount nerve staining technique: a review. Biotech Histochem. 2009 Jul 1:1-24.

PUBLISHED ABSTRACTS (related to botulinum toxin)

Shaari C, George E, Wu BL, Biller HF, Sanders I: Quantitation of the spread of botulinum toxin through muscle fascia. Abst of the AAO-ARO Research Forum, San Diego CA, 1990.

George EF, Zimble M, Wu BL, Biller HF, Sanders I: Quantitative mapping of the effect of botulinum toxin injections in the thyroarytenoid muscle. American Broncho-Esophagological Association Annual Meeting. Kona, Hawaii, May, 1991.

Shaari CM, Wu BL, Biller HF, Sanders I: Rhinorrhea is decreased in dogs following nasal application of botulinum toxin. Otolaryngol Head Neck Surg. 109;209, 1993.

Sanders I. Diffusion of toxin in muscle. Abstracts of the International Conference 1999: Basic and therapeutic Aspects of Botulinum and Tetanus toxins. Nov 15-19, 1999, Orlando, Fla.